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(54) Mouldable acoustic devices

(57) Mouldable acoustic devices internally coupled to a vehicle engine's air filter relates to a mouldable acoustic box (5), comprised of a plate of porous acoustic absorbing material or a set of plates of porous acoustic materials, superimposed and glued to each other, having its shape predetermined pursuant to the internal and acoustic characteristics of the conventional air filter to which it will be internally coupled, the device (5) being essentially an acoustic internal lining having the purpose of absorbing acoustic waves generated by inlet noises, that is coupled inside the air filter's upper compartment (1) and/or lower compartment (2), the device (5) being optionally removable f
vrom the relevant compartments.

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Description

The present invention relates to mouldable acoustic devices, and in particular to mouldable acoustic tubular lining devices made of sound-absorbing material or a set of sound-absorbing materials, which has the shape thereof predetermined according to the internal characteristics of vehicle engine air inlet components, such as air filter of an automobile, pick-up truck, truck or the like.

As is known in the automotive industry, there are known acoustic devices to be located in the interior of a vehicle engine's air filter, which can be, for example, known sound-reducers or truncated-cone sound reducers, made of plastics or metal, which are generally coupled around circular openings (1-A1, 2A1) - see Figure 1 annexed hereto, showing a lateral cross-section of a type of conventional air filter - made respectively on one side of the air filter's upper compartment (1) and lower compartment (2), the air filter element (3) being compressed between the two compartments (1,2) and the internal supports for said air filter element (3).

In the arrangement shown in Figure 1, the air is aspirated by the dirty air inlet nozzle (1-A) of the upper compartment (1) and in the aspiration sequence - indicated by the larger arrows (S-1) - the air passes through the noise reducer or truncated cone shaped sonorizer - not shown on the Figure - coupled around the circular opening (1-A1), enters the upper compartment (1), then passes through the filtering element (3), enters the lower compartment (2) of the filter and passes through the noise reducer or truncated cone shaped sonorizer of the lower compartment (2) that is coupled around the circular opening (2-A1), entering the purified air exit nozzle (2-A) and then into the vehicle's engine, whereby, simultaneously and inversely to the trajectory described above, there is a sequence of inlet noises by means of sound waves - shown sequentially by bold arrows (S-2) which finally exit through the filter's upper compartment (1) dirty air inlet nozzle (1-A).

However, such internal noise reducers or truncated cone shaped sonorizers are integral parts usually made of plastics or metal, these materials being non-acoustical but rather noise propagators, such reducers or sonorizers allowing by reason of their truncated cone shape only a modest damping of the inlet noises - by breaking up the sound waves - and that includes the engine's and air aspiration noises, exiting through the dirty air inlet nozzle (1-A).

There are also known acoustic devices which may be located in the outer part of the air filter, which can be for example, tubes or boxes that control the air input to the engine and which are arranged upstream of the air filter, coupled to the nozzle (1-A) of the dirty air inlet of the air filter's upper compartment (1). The above-mentioned conventional acoustic devices are intended to reduce the inlet noises.

Referring to Figure 2 (where like parts to those shown in Figure 1 are generally denoted by like reference numerals), a conventional clean air passage tube (5) made of rubber or plastics, which is coupled to the clean air exit nozzle (2-A) of the air filter's lower compartment (2) and to the carburetor nozzle (6) comprises merely a leak proof tube (5) that ensures a seal for the conducted air. However, the fact that the tube (5) is typically made of rubber or plastics causes it to transmit the engine noise via the filter; because the clean air passage tube (5) interconnects the air filter and the carburetor (6), it is an integral part of the vehicle engine inlet assembly.

The use of known external, acoustic tubes or boxes, and internal noise reducers or truncated cone shaped sonorizers, do not in practice achieve the desirable technical effect of noise reduction, because being typically made of plastics or metal, they do not absorb the acoustic waves to the required degree. Furthermore, the addition of tubes or boxes contributes to increase the cost of production and also takes up excessive space in the engine compartment.

The mouldable acoustic device of the present invention ameliorates the deficiencies with known arrangements.

The invention is defined in the appended claims, with preferred features being set out in the subsidiary (dependent) claims.

In a first embodiment, the invention comprises a mouldable acoustic device internally coupled to a vehicle engine's air filter, being coupled inside an air filter provided with an upper compartment (1) having a dirty air inlet nozzle (1-A) and a circular opening (1-A1) made on the wall of compartment (1) the air filter element (3) being pressed between the filter's upper (1) and lower (2) compartments and tie internal supports (4) of said air filter element, with a circular opening (2-A1) made on the wall of compartment (2), followed by purified air exit nozzle (2-A) towards the inside of the vehicle's engine, the acoustic device being made by moulding, thermopressing machine or any other appropriate manufacture process, with a predetermine shape, according to the internal and acoustic characteristics of the type of air filter in which it will be applied, the mouldable, acoustic device preferably comprising porous acoustic absorbing material, preferably comprising a lining of one or more sheets or plates of said material.

The mouldable acoustic device therefore comprises an acoustic internal lining that can assume several shapes - compatible with the internal and acoustic shapes of the conventional air filter to which it will be internally coupled (typically by gluing) - the device being therefore a stamped or thermoformed part (optionally removable), that can be coupled inside the conventional air filter's upper compartment or lower compartment.

Further preferred features of the invention can be better understood by reference to Figure 3, which shows a lateral cross-section of a conventional air filter provided with an upper compartment (1) having a dirty air nozzle (2-A) and a circular opening (1-A1) made on

the wall of compartment (1), the air filter element (3) being pressed between the filter's upper (1) and lower (2) compartment and the internal supports (4) of the air filter element, there being a circular opening (2-A1) made on the wall of compartment (2), which is followed by a purified air exit nozzle (2-A) towards the inside of the vehicle's engine.

As shown in Figure 3, the mouldable acoustic device forms a lining box (5) (of generally square, circular or any other suitable shape conforming to the interior of the filter), that is coupled (typically by gluing) to the inner surfaces of the air filter's upper compartment (1), with a circular lateral opening (5-A) coinciding with the circular lateral opening (1-A1) of the upper compartment (1) and also coinciding with the circular lateral opening (2-A1) of the lower compartment (2), the lining box (5) being open in the direction of positioning with the air filter element (3).

Accordingly, the device is mouldable in the shape of a lining box (5) of required shape, that internally lines the air filter's upper (1) and lower (2) compartments, or may line only one of these two compartments (1 or 2).

It should be explained that the mouldable acoustic device in the shape of a lining box (5) comprises a porous acoustic absorbing material or more than one porous acoustic material advantageously in sheet or plate form.

By way of example, in the case where only one acoustic absorbing material is employed in the manufacture of the mouldable lining device (5), this material can be a non-woven, porous and/or treated sheet, fibrous material or plate (for example, of polyester). Also by way of example, in the case where a set of acoustic materials is employed in the manufacture of the mouldable device (5), this set of materials can comprise superimposed lining sheets or plates glued to each other, made, for example, of porous paper, perforated aluminium or cotton tissue.

For manufacture of the mouldable acoustic device (5) is employed a mould, a thermo-pressing machine or another appropriate manufacturing process. It should be emphasised that for each type of conventional filter a study of its acoustic characteristics is made in order to allow the proper moulding of the acoustic, box-shaped lining device (5) applicable thereto.

The technical effect caused by the mouldable acoustic lining device (5) is that of absorbing the sound waves; the invention has shown a significant decibel gain in respect of prior art noise reducers or truncated cone shaped sonorizers made of plastic or metal, and acoustic external tubes or boxes.

The absorption of sound waves by the device (5) is illustrated in Figure 3, whereby the sound waves - sequence of bold arrows (S-2) - coming from the vehicle's engine through the purified air exit nozzle (2-A) enter the filter's lower compartment (2) and are initially absorbed by the device (5), as shown by the small sinuous arrow (S-3), the sound waves - already partially absorbed - passing to the upper compartment (1) through the air filter element (3), and in the upper compartment (1) are again absorbed by device (5), as shown by the small sinuous arrow (S-3) and subsequently the sound waves, with a significant decrease in intensity, as shown by arrows (S-4), exit through the dirty air inlet nozzle (1-A).

In a second embodiment, an improved mouldable acoustic tubular device has been developed to solve the technical deficiency relating to the prior art clean air passage tube (5) shown in Figure 2.

As shown in Figures 4 and 5, the device comprises an acoustic, internal, tubular lining device (7) having a predetermined shape, in accordance with the internal characteristics of the clean air passage tube (5), wherein the acoustic tubular lining device (7) will be applied internally by adhesive or the like, typically remaining fixed to the inner portion of tube (5) inner portion, the acoustic tubular lining device (7) being capable of being applied partially or totally along the tube (5) inner portion, also with an end thereof optionally extending beyond the tube (5) limit, in the coupling thereof to the clean air exit nozzle (2-A).

Figures 4 and 5 show an inlet assembly, the mouldable acoustic tubular device (7) is applied inside the clean air passage tube (5) by partial coupling, it being noted that in this example of application to the acoustical tubular device (7) - also shown separately on Figure 4, which shows a lateral cross-section of tube (5), having the device (7) internally coupled thereto - is given a straight tubular shape. One end (7-A) of device (7) extends beyond the limit of the tube (5) mouth and penetrates (7-A) inside the lower compartment (2) clean air exit nozzle (2-A) of the conventional air filter, being able to penetrate inside said clean air compartment (2).

Figure 2 also shows the sequence of aspiration of dirty air - shown by larger arrows (S-1); accordingly, the air drawn by dirty air inlet nozzle (1-A) passes through the upper compartment (1) and through the filtering element (3); the already cleaned air then enters the air filter's lower compartment (2), and the clean air flow - shown by larger arrows (S-2) passes through the clean air exit nozzle (2-A) and subsequently through the inner portion of the acoustic tubular device (7) and the clean air passage tube (5) and thence to the vehicle engine's interior, through the carburetor (6), whereby, simultaneously and inversely to the trajectory described above, a sequence of inlet noises takes place by means of sound waves - shown in sequence by bold arrows (S-3) which will be initially absorbed by the acoustic tubular device (7) and subsequently absorbed by the conventional acoustic and internal devices coupled inside the air filter's lower (2) and upper (1) compartments, and finally absorbed by the conventional external acoustic devices coupled around and outside the dirt air inlet nozzle (1-A).

It should be pointed out that, depending on the acoustic attenuation desired for the inlet assembly, the

acoustic tubular device (7) may entirely or partially dispense with the utilisation of the above-mentioned conventional acoustic devices.

Figure 5 is a lateral cross-sectional view of the conventional clean air passage tube (5), having the mouldable acoustic tubular device (7) applied by total coupling to the interior thereof, it being noted that in this example of application of the device (7) a tubular shape is provided in accordance with the internal and broken characteristics of the conventional tube (5). It is further noted that in this example, the end (7-A) of device (7) does not extend beyond the limit of the tube mouth (5) whereby, as a result, the end (7-A) will not penetrate the inside of the clean air exit nozzle (2-A) of the conventional air filter, as could penetrate nozzle (2-A) and the clean air compartment (2).

It should be explained that the mouldable acoustic tubular device (7) is manufactured of an acoustic absorbing material provided with pores, or manufactured with a set of acoustic materials, all having controlled porosity.

As an example, in the case where only one acoustic absorbing material in the manufacture of the mouldable acoustic tubular device (7), this could be a porous, non-woven polyester.

Also as an example, in the case where a set of acoustic materials are employed in the manufacture of the mouldable acoustic tubular device (7), this set of materials could comprise porous paper, perforated aluminium and cotton tissue superimposed to and glued to each other. For the manufacture of the mouldable acoustic tubular device (7) is employed a thermo-pressing machine, or a mould, or a circular weaving machine, or another appropriate manufacture process.

The technical effect caused by the mouldable acoustic device (7) is that of absorbing the sound waves, it being observed that in the device (7) has shown excellent acoustic conditions, whereby an intake assembly employing the device (7) inside the clean air passage tube (5) there will be a significant decibel gain.

Claims

1. An acoustic device for an air intake component of a vehicle engine, the acoustic device being mouldable to a predetermined shape configured to fit internally of an air intake component according to the internal and acoustic characteristics of the component, the mouldable device comprising an acoustic absorbing material which is preferably porous.

2. An acoustic device according to claim 1, which comprises a lining mouldable to the predetermined shape configured to fit internally of the component, the lining preferably comprising a sheet or plate.

3. An acoustic device according to claim 1 or claim 2, wherein the device is mouldable to form an article of box-like or tubular configuration preferably comprising one or more sheets or plates of porous acoustic absorbing material, further preferably being superimposed and bonded to one another where a plurality of sheets and plates are provided.

4. An acoustic device according to any of claims 1 to 3, wherein the device is mouldable by thermopressing or the like manufacturing process.

5. An acoustic device according to any preceding claim, wherein the device is mouldable to be configured to be internally coupled to a vehicle engine's air filter being coupled inside an air filter provided with an upper compartment (1) having a dirty air inlet nozzle (1-A) and a circular opening (1-A1) made on the wall of compartment (1) the air filter element (3) being pressed between the filter's upper (1) and lower (2) compartments and preferably tie internal supports (4) of said air filter element, with advantageously a circular opening (2-A1) made on the wall of compartment (2), followed by purified air exit nozzle (2-A) towards the inside of the vehicle's engine.

6. An acoustic device according to claim 5, comprising a box-shaped structure (5) that can be coupled (typically by gluing) and optionally removable, provided with a circular lateral opening (5-A) coinciding with the circular lateral opening (1-A1, 2-A1) of compartment (1,2), the box-shaped lining device (5) being open in the direction of positioning with the air filter element (3).

7. An acoustic device internally coupled to a vehicle engine's air filter according to claim 4 or 5, wherein the lining (5) internally lines the air filter's upper compartment (1) and/or lower compartment (2).

8. An acoustic device according to any of claims 1 to 4, wherein the device is mouldable to a tubular configuration to be coupled internally in the clean air tube of a vehicle's engine inlet assembly, attached to the inside of the conventional clean air passage tube (5) (typically made of rubber or plastics), interconnecting the air filter (2) compartment clean air exit nozzle (2-A) and the carburetor (6), the acoustic tubular device preferably being made by a thermo-pressing machine, or a mould, or a circular weaving machine, or another appropriate manufacture process, with a predetermined shape configured to the inner characteristics of the clean air tube (5) to which it is to be applied.

9. An acoustic tubular device to be coupled internally in the clean air tube of a vehicle's engine inlet assembly, according to claim 8, wherein the tubular device (7) is an acoustic internal lining (typically

applied by gluing) to the inside of the clean air tube (5).

10. An acoustic tubular device to be coupled internally in the clean air tube of a vehicle's engine inlet assembly, according to claim 8 or 9, wherein the tubular device (7) is partially or totally coupled along the inside of tube (5), with an end (7-A) optionally extending beyond the limit of tube (5) in the latter's coupling with the clean air exit nozzle (2-A).

11. An acoustic tubular device coupled internally in the clean air tube of a vehicle's engine inlet assembly, according to claim 10, wherein the end (2-A) of tubular lining (7) penetrates inside the nozzle (2-A) or penetrates inside nozzle (2-A) and the filter's clean air compartment (2).

FIG 1

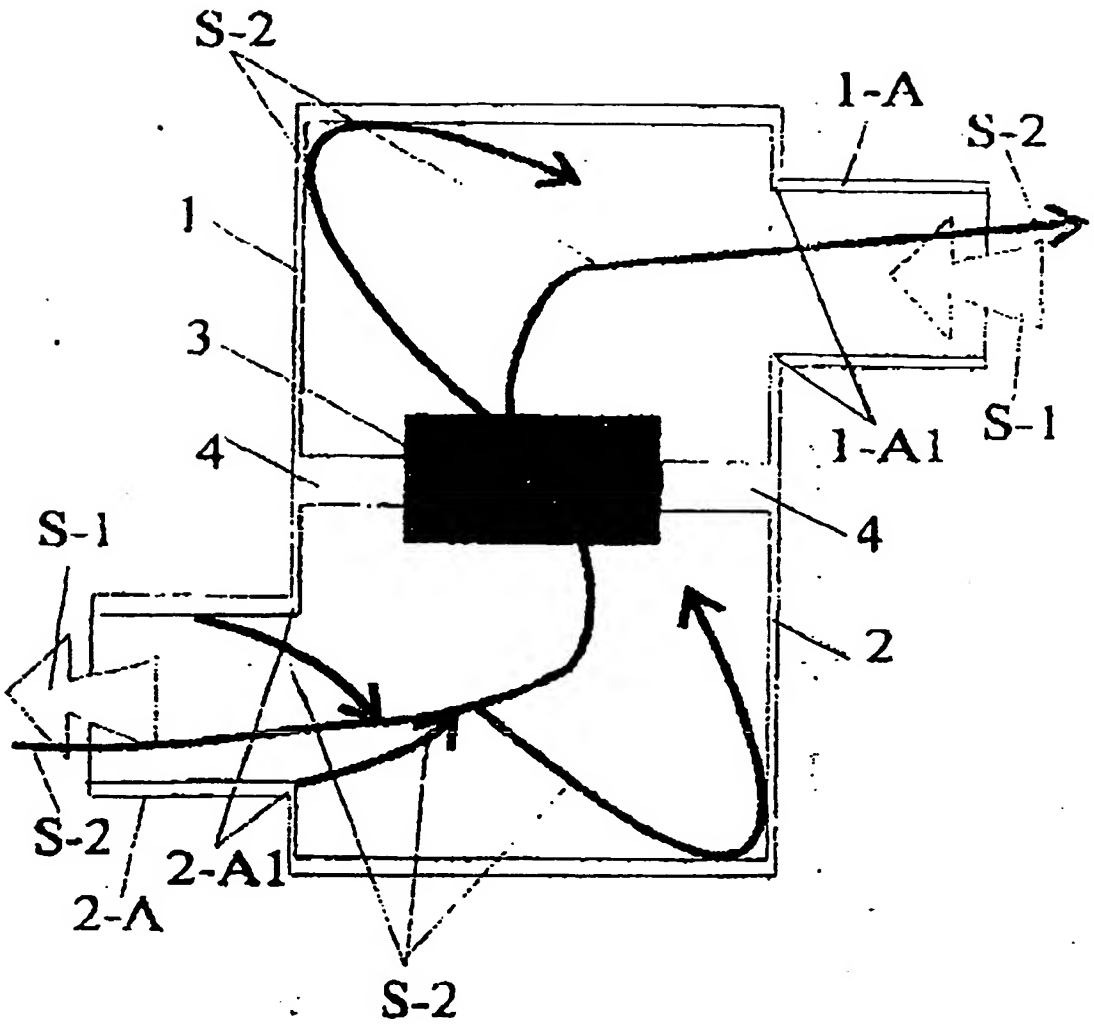


FIG 2

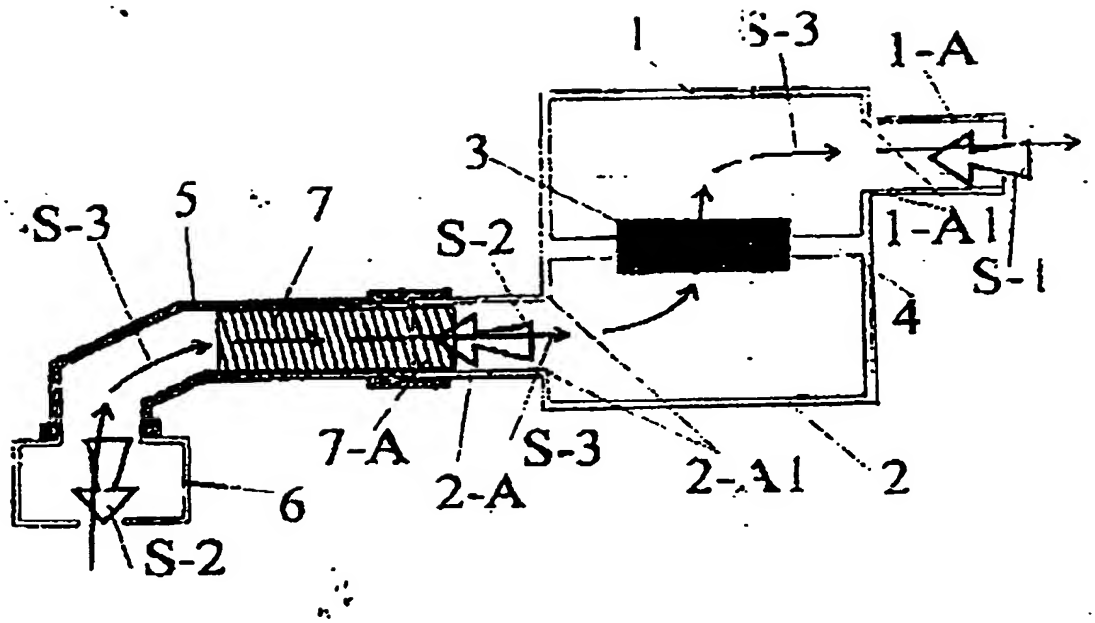


FIG 3

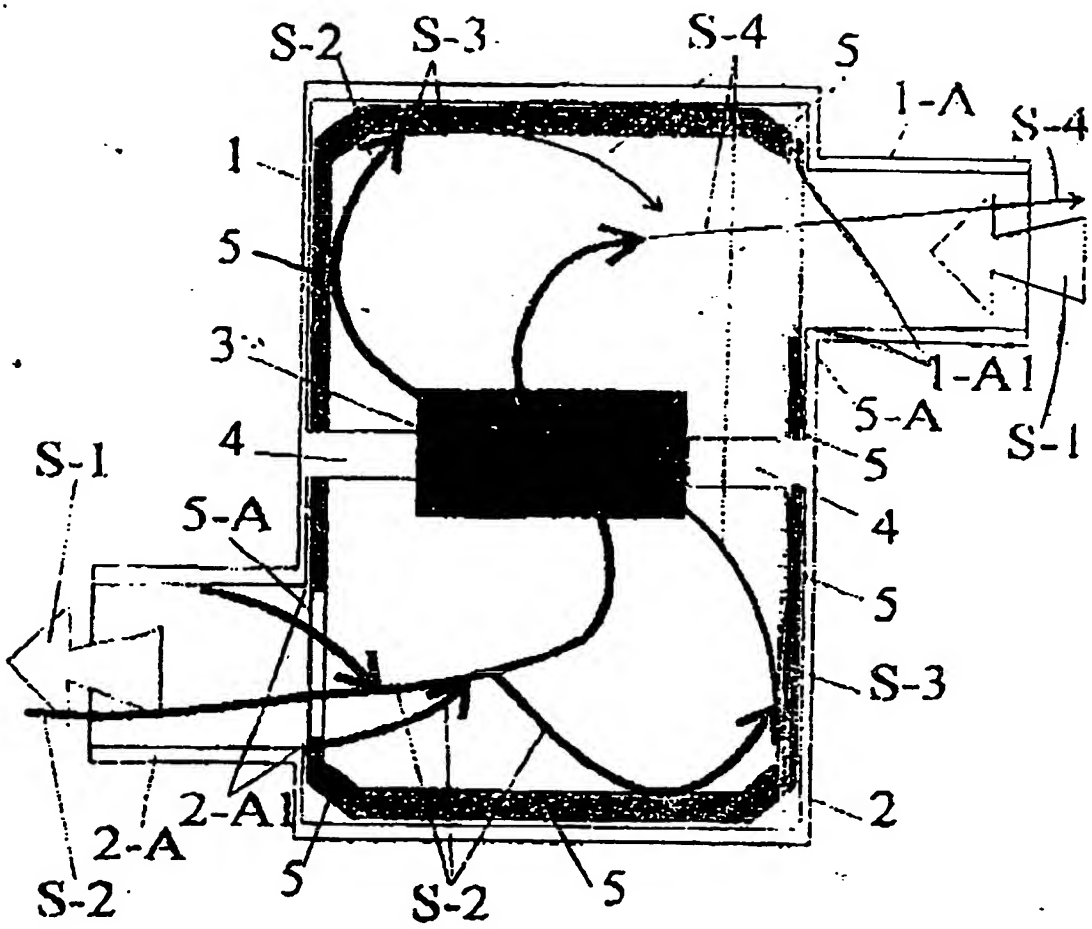


FIG 4

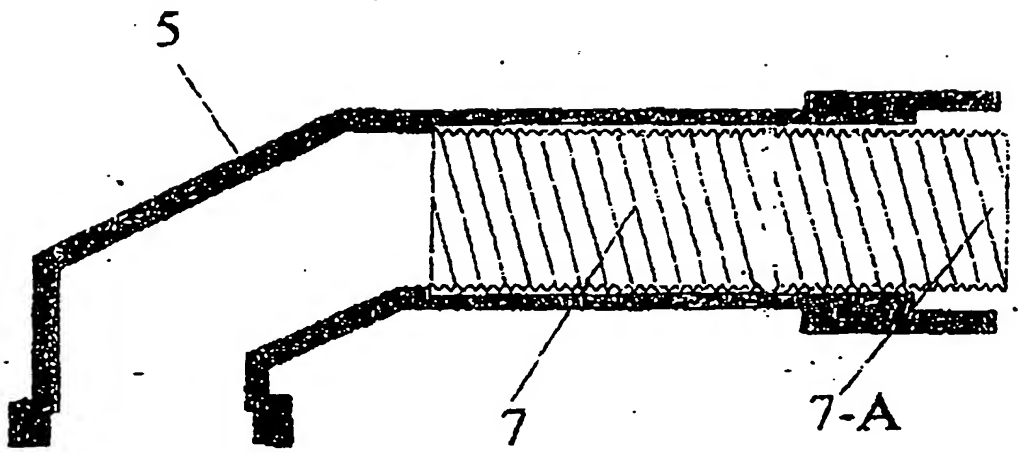
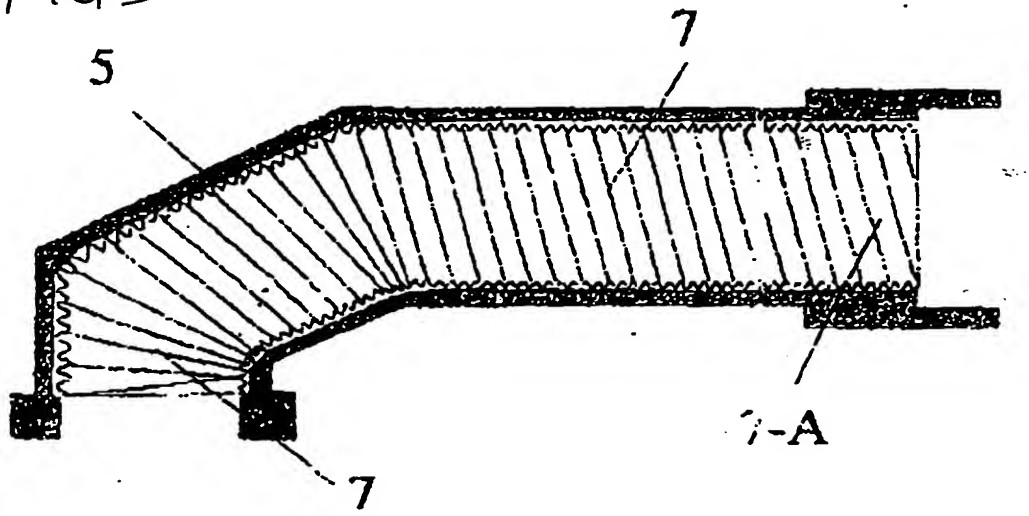


FIG 5



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EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	WO 93 19291 A (ILLBRUCK GMBH) 30 September 1993 * page 2, line 62 - page 4, line 115; figures *	1,4-7	F02M35/14
X	EP 0 435 588 A (CADILLAC RUBBER & PLASTICS INC) 3 July 1991 * column 3, line 54 - column 6, line 11; claims 1-29; figures *	1-4,8-11	
X	PATENT ABSTRACTS OF JAPAN vol. 012, no. 014 (M-659), 16 January 1988 & JP 62 174560 A (MAZDA MOTOR CORP), 31 July 1987 * abstract *	1-3,8-11	
X	PATENT ABSTRACTS OF JAPAN vol. 011, no. 339 (M-639), 6 November 1987 & JP 62 121859 A (YAMAHA MOTOR CO LTD), 3 June 1987 * abstract *	1,5	
X	PATENT ABSTRACTS OF JAPAN vol. 009, no. 149 (M-390), 25 June 1985 & JP 60 026157 A (NISSAN JIDOSHA KK), 9 February 1985 * abstract *	1,5	TECHNICAL FIELDS SEARCHED (Int.Cl.6) F02M
A	EP 0 195 121 A (PORSCHE AG) 24 September 1986 * abstract *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	9 September 1998	Alconchel y Ungria,J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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